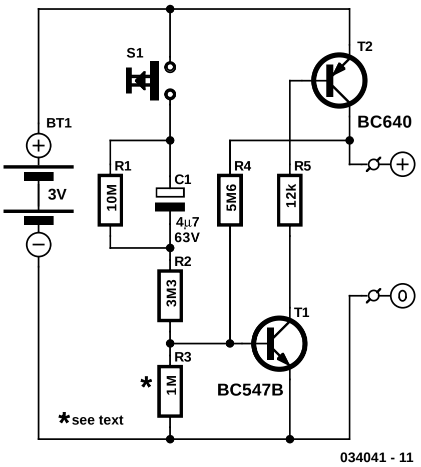
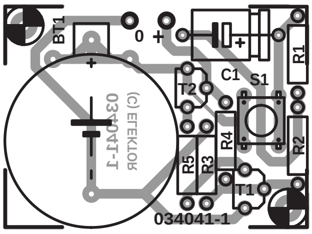
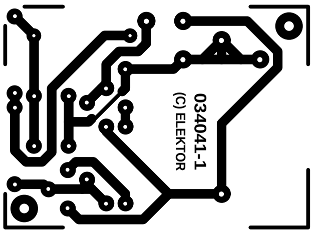
Battery Saver Switch







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There are circuits that consume only a little power or require power occasionally for short periods of time. An example of this last type is the 'FM Remote Control Transmitter'. This type of circuit can easily be powered by a small lithium button cell. The CR2032 immediately comes to mind, since it is a popular battery used in many applications and is widely available.

The circuit shown here was designed to protect these button cells from short circuits or extended current drain. Its primary function is to restrict the time that power can be drawn from the cell after a button has been pressed. In order to keep the construction as easy as possible we have designed two small PCBs that can accommodate the three most popular types of battery holders for the CR2032, including those with solder pins. There are at least two types of battery holder available for single cells: a small and wider version. Their diameters are 22.75 and 27.76 mm respectively. The PCB has been made a bit larger for use with the wider type. When such a battery holder is ordered it is not always clear if it will be a small or wider type, hence the two PCB layouts.

The circuit consists of no more than a simple comparator using two transistors. Because of its simplicity it is likely that the value of R3 has to be adjusted to obtain the required switching characteristics. In one of our prototypes the best value for R3 was 1 MΩ and in another it was 2.2 MΩ. It should be chosen such that the circuit can switch on properly with a supply voltage of about 2 V.

Determining the correct value for R3 is very easy. Using a variable power supply, the voltage should be decreased slowly (starting at about 3 V), and C1 should be discharged every time before pressing S1 again. At 4 V or just above the circuit should still switch off (keep pressing S1 and slowly increase the supply voltage). The switching characteristics also depend upon the current gain of both transistors and the voltage drop across the base/emitter junctions. When there is a short circuit the current is limited to a few mA's because in that case R4 won't provide extra bias to T1.

The circuit is so simple that it should be easy to adapt it for your own needs. There is another standard battery holder (also with a diameter of 27.76 mm) that takes two CR2032 cells on top of each other, giving a nominal supply voltage of 6 V. In that case you will have to determine the component values yourself. R1 discharges C1 when the switch is open. This time has been made fairly large on purpose, about 50 seconds! The

COMPONENTS LIST

Resistors:
R1 = 10MΩ
R2 = 3MΩ3
R3 = 1MΩ*
R4 = 5MΩ6
R5 = 12kΩ

Capacitors:
C1 = 4µF7 63V axial

Semiconductors:
T1 = BC547B
T2 = BC640

Miscellaneous:
S1 = 6-mm 'tactile switch', e.g., MCDTS6-5R (Farnell # 312-1033)
BT1 = 3 V CR2032 with PCB mount holder (dia. 22.75 or 27.76 mm)*

* see text

advantage of this circuit is that as the battery voltage becomes lower, T1 stops conducting earlier and hence saves the battery even more. With C1 fully discharged and a fresh battery the on-time is between about 15 to 20 seconds. We have assumed that the circuit will be used in applications where S1 will only be switched on momentarily. When S1 is accidentally switched on for longer then C1 will prevent the battery from discharging quickly. The current drain will then be below 0.3 µA.

A construction tip: if the circuit is housed in a small case it may be easier to mount the switch on the solder side of the PCB.

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